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Impacts of Organizational Structure on the Effectiveness of Emergency Response System

Submitted in partial fulfillment of the requirements for the degree
Master of Science in Urban Planning

by
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Abstract

The thesis focuses on the impacts of Organizational Structures on the effectiveness of the emergency response system under different cultural contexts. By comparing the situations of Hurricane Harvey in Houston, United States and Super Typhoon Hato in Zhuhai, China, it turns out that the Organizational Structures in both countries are effective in different aspects, with the American structure, which is horizontal and distributed, more comprehensive and the Chinese structure, which is hierarchical and condensed, more efficient.

Instead of the traditional planning theory standpoint claiming that the effectiveness can be directly influenced by the level of centralization of the Organizational Structures, this paper offers a new way of thinking, arguing that it is the stability of the inter-organization connections within the Organizational Structures that essentially affects the outcome of the emergency response systems. The permanence of the connections among the public and private organizations can be revealed by the collaboration form, quantity of the engaged organizations, trust among the organizations and the legitimacy of the structure.

Keywords: Organizational Structures, system effectiveness, community, stability, inter-organization connection, collaboration form, Organizational Structure size, trust, legitimacy

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The thesis is a reflection on the current Organizational Structure under different cultural contexts as well as its impacts on the effectiveness of the emergency response systems, which is proposed to create a new way of thinking for planners when establishing Organizational Structures of other kinds. I hope it could provide deep insights and serve as inspirations for the planners in the future to make the Organizational Structure more balanced to be effective in a more holistic way.

Contents

Chapter 1 Background and Introduction

Natural disasters could be a big challenge to maintaining and sustaining the fragile urban environment in recent years. Hurricanes, typhoons, earthquakes, floods, and many other natural disasters destroy urban areas in a quick and fierce way, for which human beings try to respond timely and minimize the negative impact on the citizens and cities. As the first and front line of disaster management, the effectiveness of the emergency response system has become a major focus of researchers and governmental officials. What should be noticed is that an effective emergency response should not rely on the governmental agencies solely, the joint efforts of the non-profit organizations, faith-based organizations, communities, and the residents are also important (Xu et al., 2015). This paper will examine the impact of Organizational Structures on the effectiveness of the emergency response systems under different social and political systems. The essence of the correlation between Organizational Structure and the system effectiveness will be figured out and innovative insights will be provided for urban planners when establishing different Organizational Structures for specific purposes.

There are two typical Organizational Structures behind emergency response system, horizontal and hierarchical, which are actively functioning in the modern societies. To compare the differences and the impacts of the Organizational Structures, one typical case is selected from each for comparison. The one for the horizontal structure is in the United States given its abundance of the community organizations while the other one for

the hierarchical structure is in China given its worldwide reputation of highly centralized governmental system.

Cross-sector Collaboration in the Houston, U.S.

Cross-sector collaboration is commonly observed as a fundamental method to cope with the natural disasters in the United States when the emergency occurs. It is defined as "partnerships involving government, business, nonprofits and philanthropies, communities, and/or the public as a whole" toward mutual goals (Simo & Bies, 2007). Organizational structures for collaboration can vary from informal and episodic activity, such as one-time task forces, to highly formalized contracts between organizations.

In 2017, Hurricane Harvey damaged Houston urban area and caused tremendous property loss and even life loss in the summer. Cross-sector collaboration has operated well in terms of responding to the citywide widespread and catastrophic flooding. For the governmental agencies, the Coast Guard deployed 2,060 personnel, 50 aircraft, 75 boats, and 29 cutters, rescuing 11,022 people and 1,384 pets (FEMA, 2017). The Federal Emergency Management Agency (FEMA) assigned 28 Urban Search and Rescue (USAR) teams from across the nation to deploy to Texas to assist state and local agencies with the lifesaving mission. The teams rescued 6,453 people and 237 animals, using boats and high-water trucks. Search and rescue efforts involved USAR, National Parks Service, U.S. Fish, and Wildlife Service, Customs and Border Patrol and the Department of Defense. The

Department of Health and Human Services (HHS) deployed more than 1,110 personnel with medical equipment and supplies (FEMA, 2017).

Meanwhile, more than 300 voluntary organizations, including National and Texas Voluntary Organizations Active in Disasters and locally based groups, are working to support Harvey survivors (FEMA, 2017). Cajun Navy, an informal network of volunteers with small watercraft, mobilized in the wake of unprecedented flooding in Houston (Toppo, 2017). H-E-B, the supermarket chain out of San Antonio with stores across South and Central Texas, provides free meals for the impacted people (Solomon, 2017).

Governmental-oriented Collaboration in Zhuhai, China

In 2017, China also encountered a severe typhoon disaster in the same period when Super Typhoon Hato attacked the cities of Zhuhai, Jiangmen, and Zhongshan. Under the extreme condition of heavy rainfall, farmlands were flooded, houses were damaged, roads were blocked, and urban areas were waterlogged. However, on the contrast, the army and the government is the dominant power in responding to the disaster though non-profit organization and communities have limited influence. The Chinese People's Liberation Army (PLA) garrison, People's Armed Police (PAP) forces, and militia reservists, reacted right away on orders of the central government, working on the frontline of emergency rescue and disaster relief. More than 2,700 personnel were sent under Guangdong provincial military command, rescuing and evacuating more than 1,400 people in the affected areas (Zhou, 2017).

The Flood, Windstorm, Drought Control Office, the information hub and command center of the disaster-stricken district, took actions rapidly by coordinating the key governmental agencies and integrating the resources to cope with the emergency intensively. When the Flood, Windstorm, Drought Control Office's subordinate groups working closely with specific governmental departments, each member unit united and cooperated based on their functional division in the emergency response.

After the storm, many enthusiastic citizens spontaneously organized to help the affected people. In Macau, the New Chinese Youth Association has organized an online activity called "Windward Street Cleaning", aiming to clean up the streets for the convenience of the rescue work. Other grass-roots organizations such as the Progress Promotion Union and the Women's General Association of Macau have all taken part in disaster response (People's Daily, 2017).

The fast reaction to the disaster and the effective emergency relief have significantly secured the safety of the citizen and their property. Under the extreme circumstances, the government-oriented response and rescue system at community level also has a positive influence.

Comparison Mechanism

The comparison of two cases should be established on a similar basis, which minimizes the influences of other factors so that the outcome could be regarded as the result of the Organizational Structure change solely. In other words, the disaster type, the

time when the disaster happened, the disaster scale, and the stricken area characteristics should be analogical to form a comparable basis of the two cases.

Hurricane Harvey and Super Typhoon Hato both happened in the summer of 2017 with similar severity. Hurricane Harvey lasted from August 17, 2017 to September 2, 2017, defined as Tropical Depression (NHC/CPHC) and Category 4 Hurricane (SSHWS) (Hurricane Harvey, Wikipedia) while Super Typhoon Hato existed from August 19, 2017 to August 25, 2017, categorized as Category 2 Tropical Cyclone (BOM) (Typhoon Hato, Wikipedia). The highest wind speed of Hurricane Harvey and Super Typhoon Hato were 130 mph (World Vision, 2018) and 115 mph (Typhoon Hato, Wikipedia) respectively. The stricken cities of the two disasters are also comparable. Houston and Zhuhai are both tier-two cities in their countries. In 2017, the population in Houston was 2.313 million (Houston, Wikipedia) and the population in Zhuhai was 1.765 million (Zhuhai, Wikipedia).

Comparing the performance of the two different emergency response systems at community level, the cross-sector collaboration in Hurricane Harvey and the governmental-oriented collaboration in Super Typhoon Hato could be valuable for urban planning as the advantages and disadvantages of the two systems will be clear and the Organizational Structures could be improved in the future.

Chapter 2 Literature Review

Emergency Management

Emergency management has increasingly received public attention in a world where catastrophic disasters (emergencies) and extreme events (crises) affect the urban areas more and more fiercely (Kapucu, 2008). Given the fragility and heterogeneity of the urban environment, researchers have attempted to figure out different emergency management models that could be applied at local community.

One of the most frequently adopted models in America is the comprehensive emergency management including four phases, mitigation, preparedness, response, and recovery, during which the organizational involvement and collaboration in emergency management system vary. Under the cases for natural disasters, the agencies and organizations of all level have the greatest opportunity of coordination and interaction. As the diagram shows below, federal agencies provide recovery assistance for major disasters while state emergency offices prepare for and coordinate response to large disasters. Local governments maintain warning systems and respond to all disasters in their areas. The

private sector has a significant effect in preparing for and responding to the natural disasters at the local level (National Governors' Association, 1979).

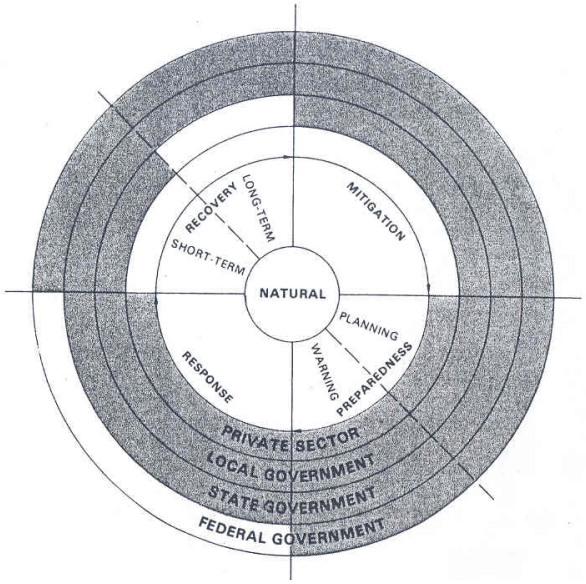

Figure 1 Organization Engagement of All Levels in Emergency Management

Resources: National Governors' Association, 1979

The activities for each phase in the cycle is also different. Any activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies should be integrated into the mitigation phase. Plans or preparations made to save lives and to help response and rescue operations are typical in emergency preparedness. The activities happening in emergency response phase mainly include actions taken to save lives and prevent further property damage under the extreme conditions while recovery aims to return to a normal or an even safer situation following an emergency (FEMA, 1998). Since there are no specific time nodes between different phases and activities for different purposes may occur at the same time to

minimize the negative impact of the disaster, it is more proper to define emergency response by certain activities instead of by time series.

On the contrast, the separation of responsibilities among federal government, state government, local government, and private sector isn't observed in China. Instead, the hierarchical emergency management system works consistently and collectively throughout the emergency life cycle. The whole system emphasizes the implementation of the main responsibility of local emergency management and the comprehensive coordination among different public agencies and departments (Wang & Tian, 2006).

In the process of emergency management, Chinese Central Government assumes overall control and command. Local governments exercise unified leaderships with relevant functional departments collaborating closely with each other and undertaking separate assignments quickly and efficiently. The role of armed forces in emergency management is highlighted in terms of optimizing and allocating the various emergency relief forces and resources to ensure the overall joint effort from the Organizational Structure (Li, 2004).

On the concept of structural-based power in networks, Chinese emergency management system tends to own more formal power. Positions of such formal authority possess more clear perceptions of network members (Choi & Brower, 2006; Krackhardt, 1990) and also generate stronger decision-making power (Brass, 2006). On the contrary, the American system is inclined to informal power, which comes from actors' interactions

with others within a network (Choi & Kim, 2007) and indicates different degrees of access to and control over valued resources (Howell, Burt, & Minor, 2006).

Cross-sector Collaboration

Cross-sector collaboration is important in the emergency response system in the United States, which is defined as the linking or sharing of information, resources, activities, and capabilities by organizations in two or more sectors to achieve jointly an outcome that could not be achieved by organizations in one sector separately (Bryson, Crosby, & Stone, 2006). The concept has proliferated in recent years as the organizations in the collaboration are trying to make accomplishments which could not be achieved by a single organization (Provan & Kenis 2008, 240). Based on the review of reports of seven incidents in the United Kingdom and in other parts of the globe from a range of sectors and with varying parameters, Crichton, Ramsay, & Kelly (2009) concluded that the organizations can become wiser and their emergency plans could be more resilient by learning from incidents of other sectors. Nonprofit involvements in cross-sector collaborative efforts are also examined for post-Katrina and Rita relief, recovery, and rebuilding, where organizational capacity has been improved through the close collaboration among different sectors (Simo & Bies, 2007).

The collaboration processes are so complicated that the attempts to form simultaneous analyses of all the moving parts are unrealistic (Berardo, Heikkila, & Gerlak, 2014) and a systemic view is necessary in order to understand how the separate parts fit

together and to avoid unintended deleterious effects (Bryson, Crosby, & Stone, 2015). According to the analysis on the Emergency Management Survey 2012 in the Southeastern Economic Region (SER) in South Korea, organization collaboration process stresses autonomy, and partnership is generated by voluntary agreements, which is hard to detect and control under the extreme situations (Jung & Song, 2015).

The key characteristics of such collaboration networks as well as their effectiveness have been studied by groups of scholars. Formal and informal processes are taken into account in the formation of such networks, including but not limited to agreements, leadership, legitimacy, trust, conflict management, and planning, resulting in different collaboration structures as membership, structural configuration and governance structures (Bryson, Crosby, & Stone, 2006).

The cross-sector collaboration level could be explained in a regression model, in which the total intergovernmental collaboration could be determined by future concerns, past experiences, total training functions, state training certification, stand-alone agency when controlling total nongovernmental collaboration, fragmentation, distance to the state capital, SoVI score, and percentage of urban population. The result turns out that the total intergovernmental collaborative activities could be largely influenced by the managerial and technical capabilities of the public managers and the agencies he or she works in. And the more well-defined the program areas of the organizations, the more effective and efficient the collaboration would be (McGuire & Silvia, 2010).

However, more and more opposite voices emerged as the collaboration of different agencies and organizations in emergency response has become a major trend worldwide. Criticisms mainly focus on the redundancy and inefficiency of information sharing and the ambiguity and overlap of the duty segregation among different parties in such cooperative structures. In the case of the emergency response to the Fort Worth tornado, though it exhibited a significant degree of coordination, the collaboration process among the agencies and organizations was hindered by insufficient or overwhelming shared information, which was also inaccurate or incomplete when relayed to different parties, and the overstepped power of some of the authority (McEntire, 2002). It is also hard to define if there are genuine collaborations happening in the structure because of the nebulous definition of collaboration and the lack of widely accepted models in academia. When the level of interaction among the parties is relatively low, though they are working to achieve the same goal of mitigating the negative impact of the emergency, the activities may be referred as “parallel play” rather than genuine collaboration. Even if the communication, information provision, or contact among different parties are frequent, this kind of activities alone don’t necessarily mean that there are collaborations among the parties (Robinson & Gaddis, 2012).

Hierarchical System

China enjoys a worldwide reputation of its highly hierarchical government system, which is the result of the Chinese culture features, highlighting the respect for age and

hierarchy, group orientation, face, and the importance of relationships (Lockett, 1988). Such a hierarchical and vertical structure is also embedded in its emergency response system. In Chinese Organizational Structure, the single political party exerts strong influence over the parallel government administrations and operates dominantly to reduce disagreements among multiple parties in emergency response (Col, 2007).

The advantages of such hierarchical system are distinct in the joint efforts of multiple parities towards the shared goal and the efficiency of the emergency response system derived from the strong dominance of one single party. Healthy political climate and positive media were observed in the prompt centralized government in the Sichuan earthquake relief coordination process, which reveals the strong capability of the Chinese government to act and respond (Kapucu, 2011). Efficient military involvement in domestic disaster relief is guaranteed with Chinese hierarchical system (Liao, 2012).

The disadvantages of such hierarchical system are equally important in evaluating the Chinese emergency response system. Regarding emergencies as extensions of "enemy attack" scenarios in its military analogies, the centralized structural arrangement is generalized as the appropriate normative model for all emergencies, which could be achieved by command and control (Dynes, 1994). However, the disproportionate emphasis on the role of the centralized government could lead to severe outcomes as the emergency management does not follow the prior emergency planning automatically

(Quarantelli, 1988) and the events are highly dynamic and complex (Dynes & Quarantelli, 1969).

Given the high diversity of the emergencies the government has to face and cope with, many researchers pointed out at an early stage that the traditional bureaucratic hierarchies are replaced by the inter-organizational coordination, which is a qualitatively different form of governance structure (O'Toole, 1997; Powell, 1990). Effective emergency management requires the centralized government to integrate the power of all levels of subordinate governments, social organizations and even the private sector (Zhang, 2003). In order to offset the disadvantages of the hierarchical structure, Liu and Xiang (2005) put forward that a more flexible organizational structure should be adopted in Chinese emergency response system for better performance. They believe that the Organizational Structure in China should transform from the traditional single centralized government to a more pluralistic social governance network.

In short, the situation in China is a representation of the bureaucratic hierarchies while the counterpart in the United States reflects the inter-organizational coordination. The comparison of the two cases and their effectiveness could have a significant implication on emergency response systems.

System Effectiveness

How to measure the relationship between the effectiveness of the emergency response systems and the Organizational Structure is a difficulty for the research. To date,

the measurement technology for the effectiveness of the collaboration networks is still rudimentary (Robinson & Gaddis, 2012). Though the topic appears to be of interest for scholars, few researches of the survey on collaboration among public agencies has been conducted. The early survey of collaboration among public school districts in Texas links the data of collaborative management to the other management issues, placing emphasis on the regular and repeated interaction though it didn't clearly elaborate the nature of such contacts (Meier & O'Toole, 2001). In contrast, information sharing is considered as sufficient and valid evidence of genuine collaboration regardless of the frequency of the contacts among parties in the activity-based measurement of collaboration (Agranoff & McGuire 2003). The effectiveness of the Organizational Structure can also be evaluated by four key structural and relational contingencies, which are trust, size (number of participants), goal consensus, and the nature of the tasks, which is the need for network-level competencies (Provan & Kenis, 2008).

Given the nature of the emergency response to the natural disasters, activity-based measurement could be proper at the initial stage of the organization structural development as the real-time information sharing is the most important factor in timely response. Nonetheless, in the long term, the measurement of the frequency of inter-organization interactions should be taken into account in order to establish a stable and effective Organizational Structure.

Chapter 3 Methodology

The thesis research focuses on comparing the impact of different Organizational Structures on the effectiveness of the emergency response systems at community level in Houston, United States and in Zhuhai, China. In order to get a comprehensive understanding of the Organizational Structures behind emergency response systems, the working methodology is qualitative oriented to better serve the research purposes.

The methods mainly consist of governmental report collection and analysis, semi-structured interviews, and case comparison. They are designed to form a comprehensive picture of the Organizational Structure and to evaluate the effectiveness of the emergency response system based on the information collected through the process.

Data Resources

Type of Resources	Number	Name
Houston, United States		
Government Documents	5	Historic Disaster Response to Hurricane Harvey in Texas
		2017 Hurricane Season FEMA After-Action Report
		After-Action Review Report of Texas Commission on Environmental Quality
		Hurricanes Nate, Maria, Irma, and Harvey Situation Reports, Department of Energy
		National Hurricane Center Tropical Cyclone Report of Hurricane Harvey
Social Organization Reports	3	Global Philanthropy Group Situation Report of Hurricane Harvey
		Humanity Road Summary Hurricane Harvey Response
		American Logistics Aid Network Hurricane Harvey Situation Report
Interviews	2	Subjects Unnamed for Privacy
Zhuhai, China		

Government Documents	8	Work Summary Report of Disaster Control Office in 2017
		Survey Summary Report of Prevention and Control of Super Typhoon Hato in Zhuhai
		Report on the Disaster Relief and Recovery of Super Typhoon Hato
		Emergency Plan for Strong Typhoon Defense in Zhuhai
		Zhuhai Flood and Wind Emergency Response Responsibility Manual
		Zhuhai Typhoon Shelter and Rescue Plan
		Super Typhoon Hato Emergency Disposal Notice
		Super Typhoon Hato Disaster Relief Work Daily Situation Report
Social Organization Reports	2	NPI Public Welfare Development Center's Participation in Super Typhoon Hato Disaster Relief Situation Report
		Zhuhai Social Work Committee Disaster Relief Work Situation Report
Interviews	5	Subjects Unnamed for Privacy

The government reports are important inputs for the research as they include qualitative information about how the organizations collaborate with one another, the statistical data about the resources being distributed in the emergency response period, and the results of the joint works that have been made. Situation reports from federal military and governmental agencies like FEMA, Department of Energy, and Department of Defense in the United States as well as the reports from the Central Municipal Government, National Emergency Response Office, and National Bureau of Statistics in China could reveal the relationships among the agencies and organizations and the activities they took during the emergency response period. Ancillary reports from local government agencies, like the Texas Department of Public Safety in Texas and the Municipal Government in Zhuhai, give a more detailed perspective of the emergency

response system at a local level. Additionally, non-for-profit, faith-based and volunteer organizations like Church World Service, All Hands and Hearts, American Logistics Aid Network, and the Red Cross provide more situation reports for their own organizations, which are publicly available on their websites, containing abundant supplementary information about the stakeholders in the emergency response systems and the efforts they made respectively and collectively.

Semi-structured interviews are another major resource for filling the information gap between government agencies and non-profit organizations, supplementing the data collected from the other resources and adding personal experience of the subjects to the research. The subjects of the interviews mainly are the planners, nonprofit organization workers, community organization workers, and community residents, who have experienced the two disasters and are familiar with the emergency response process at community level.

Governmental and Organizational Report Analysis

The governmental and organizational reports could be official or unofficial records of the collaborative connections among different organizations. Such collaborations could be formal or informal. For the former one, the collaborations take the forms of official cooperation, subsidy distribution and joint programs. As for the informal collaborations, information, services, and resources sharing as well as money and resources donation are the most commonly observed forms in emergency response systems.

Based on the Organizational Structure information derived from the governmental and organizational reports, the collaborations among different organizations will be revealed. A diagram of the network could be drawn to show the relationships within the structure more clearly and intuitively where the participants of the structure, public or private, will be listed. The formal collaborations will be displayed with solid arrows while the informal collaborations are in dashed arrows.

Semi-structured Interviews

The interviews are the supplements of the report research in establishing a holistic understanding of the Organizational Structure. Though formal collaborations among the public agencies, social organizations, and private sector are easy to detect in the public reports, the informal collaborations always take subtler forms, which may not be recorded in the reports and are hard to observe solely from the reports. Therefore, the semi-structured interviews are designed to gain more information of the organization collaborations and to fill the research gap.

The semi-structure interviews start with some general questions about the role of the organizations played and the outcomes of the organizational collaborations in the emergency response systems for Hurricane Harvey or Super Typhoon Hato. Then it further asks about the informal forms of interorganizational collaborations within the structure, including informal information flow, services sharing, resources sharing and donation.

Case Comparison

In a similar context, the two cases will be compared in various aspects of the Organizational Structure and the emergency response system effectiveness. Also, the features derived from the Organizational Structure which, at the meantime, have important influences on the emergency response system effectiveness will be found and examined. Implications regarding organization structural tensions will be put forward to improve emergency management structures in urban planning.

Given the specific circumstance of hurricane and typhoon emergency and combined with precedent literature theories, four features of the Organizational Structures will be examined respectively in each case to explain the relationship between Organizational Structure and the systematic effectiveness. The four features to be compared are collaboration forms, size of the structure (number of involved organizations), trust, and structure legitimacy.

Chapter 4 Research Findings and Discussion

Findings Overview

After the data collection and analysis, the research findings for the two cases are distinct. The Organizational Structure of Houston is more horizontal and distributed while that in Zhuhai case is more hierarchical and denser. Accordingly, the effectiveness of the emergency response systems of the two cases are different, where the Houston case is

more comprehensive and the Zhuhai case is more efficient. The imparity of the emergency response systematic effectiveness is directly affected by the Organizational Structure as the other influence factors are excluded, which consist of disaster type, the time when the disaster happened, disaster severity, and stricken area characteristics.

Collaboration Forms

Collaborations among organizations could take highly diversified forms. Based on the degrees of collaboration intensity, organization autonomy and resources commitment, the collaborations among agencies and organizations could be located on a continuum where at the one end is the simple one-time information or resources exchange among the organizations while at the other end is the full legal merger of the two organizations (Murray, 1998). Guo and Acar (2005) put forward that there are eight different forms of collaborative activities based on the levels of formality, including information sharing, referral of clients, sharing of office spaces, joint program, management service organization (MSO), parent subsidiary, joint venture, and merger. They further collapsed these forms into two major categories: informal collaboration (information sharing, referral of clients, sharing of office spaces, and MSO) and formal collaboration (joint program, parent subsidiary, joint venture, and merger).

For the purposes of the research on emergency response system, the collaboration forms here will also be classified into the formal and informal categories, but the items of each category will change. For the formal collaboration, the forms the organizations would

take are official cooperation, subsidy distribution and joint programs. As for the informal collaborations, information, services, and resources sharing as well as money and resources donation are taken into account in emergency response systems.

Structure Size

Size of the structure, also known as the number of involved public agencies, social organizations, and private businesses, could reveal the level of engagement of the Organizational Structures under the emergency. As the number of organizations participating in a network grows, the number of potential relationships increases exponentially (Provan & Kenis, 2008). In other words, the more participants in the structure, the more comprehensive the emergency response system could be. Taking advantage of the aggregation effect within the structure, the organizations could provide more holistic aid and services with a higher structural capacity. The organizations could take care of more community issues through formal and informal collaborations.

However, on the other hand, the emergency response system could become less efficient when the size of the structure reaches certain amount. The leader agency or organization has to take more time and efforts to integrate the information and resources from and avoid the redundancy, inconsistency, and inaccuracy caused by such large amount of organizations.

The argument for the case comparison in Houston and Zhuhai is that the size of the Organizational Structure could be a significant factor in the emergency response system effectiveness in terms of comprehensiveness and efficiency.

Trust

Trust refers to "the willingness to accept vulnerability based on positive expectations about another's intentions or behaviors" among Organizational Structure members (McEvily, Perrone, & Zaheer, 2003). It could be demonstrated in various ways, including future-based (Bradach & Eccles, 1989), deterrence-based (Rousseau, Sitkin, Burt, & Camerer, 1998), characteristic-based (Creed & Miles, 2012), norm-based (Provan & Kenis, 2008), calculus-based (Rousseau et al., 1998), institutional-based (Zucker, 1986), identity-based (Gibbs & Coleman, 2006), and process-based (Zucker, 1986).

All the trust types could be collapsed into four broader categories, future expectation, risk management, organizational reputation, and activity repetition. For the future expectation, trust is obtained through interorganizational agreements at the early stages of a collaboration, where trust serves as a substitute for formal documents (Bradach & Eccles, 1989). Future-based trust is the representative of the category. Risk management is another category as trust is gained by sanctions for potential violation of the interorganizational collaboration(Rousseau et al., 1998). Under this category, deterrence-based trust is the most typical type. Organization reputation is established through its historical activities of the organization on which trust could be built on. This type of trust,

deriving from the organization's historical activities and reputation, has been referred to as "characteristic-based" trust, "norm-based" trust, "calculus-based" trust, and "institutional-based" trust. Activity repetition is the fourth category where trust is built on the performance of the organizations through repeated interactions. Reciprocity is at the heart of this process (Creed & Miles, 2012). Identity-based and process-based trust are classified into this category.

The trust among the organizations could play an important role in the effectiveness of the emergency response systems. The system could be more efficient and comprehensive if stable and deep trust is widely spread in the organization system.

Legitimacy

Structure legitimacy can be divided into internal legitimacy and external legitimacy. The internal legitimacy refers to the status and credibility of the network and network activities as perceived by member organizations (Human & Provan, 2000). The external legitimacy is the external ''face'' of the network, which should be responsive to external expectations (Provan & Kenis, 2008). Both internal and external legitimacy are important for the effectiveness of emergency response system as it requires the organizations to undertake their assignments quickly and to attract emergency relief resources from the whole society.

Such legitimacy could be greatly influenced by the structure of the organizations as member organizations and external entities in different structures have different level of

understanding, compliance and execution of the role they play in the whole process, which could result in different outcome or effectiveness.

Based on the findings overview, the two cases in Houston and Zhuhai will be analyzed in three aspects separately, the Organizational Structure, the emergency response system effectiveness, and the impact of the former on the latter.

Houston, United States

Organizational Structure

Based on the collection and analysis of the situation reports of government agencies, public departments, social organizations, and private businesses, it turns out that the Organizational Structure in Houston case is flat and distributed both in normal and emergency circumstances. Compared to the normal situation when the member organizations operate independently to serve their own interest groups, the emergency situation triggers the establishment of a complicated and condensed Organizational Structure temporarily when all the member organizations share the consensus goal of protecting the local community from the hurricane.

Regular Situation

The "Organizational Structure in Houston Under Normal Circumstance" (Figure 2) tells that the Organizational Structure in Houston typically has the characteristics that different sectors function separately with a few connections among disparate sectors and

collaboration is prevalent between agencies or organizations within the same sector. In other words, the organization collaboration pattern tends to cluster at sector level and disperse at inter-sector level.

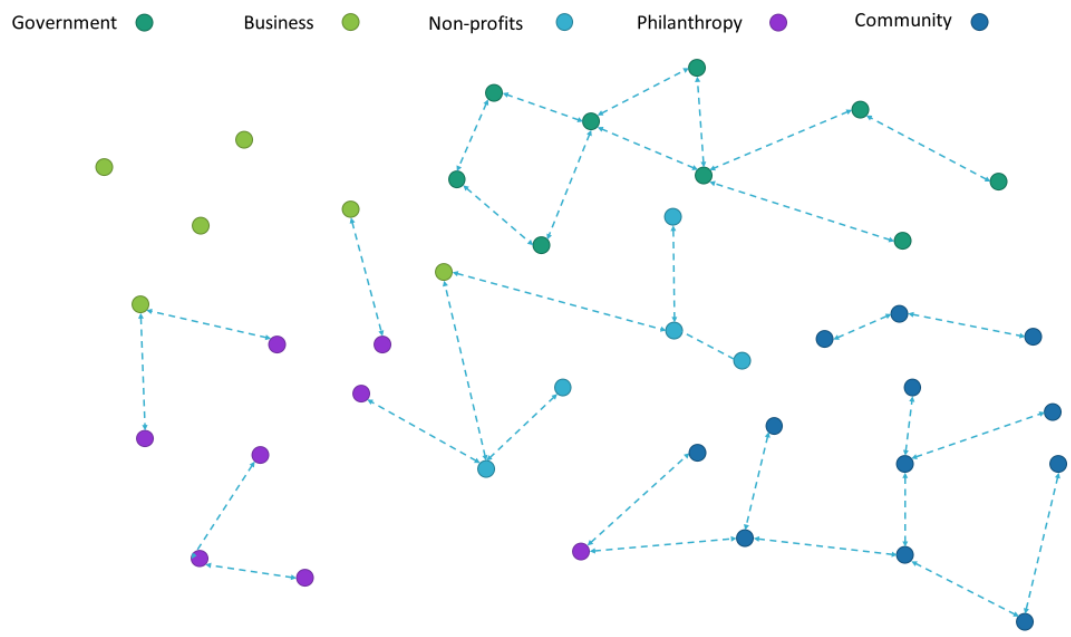

Figure 2 Organizational Structure in Houston Under Normal Circumstance

Resources: Author created based on public reports

Federal control and influence are limited in the area. The dominant power of government agencies is at state and local level. Houston Office of Emergency Management is the principal entity in emergency planning while other public departments concentrate on maintaining the regular operation of the City of Houston and providing specific services to the Houstonians.

Social organizations including non-profit organizations, ethnic communities, faith-based groups, philanthropy groups, community organizations, and voluntary organizations function relatively independently for their own interest groups and cooperate with one another occasionally on certain events, activities and programs.

The level of collaboration within private sector varies based on the business type. Utility companies have formed mutual support networks, which will only be activated under special circumstances. Nationwide chain food stores have stable supply chain and fixed commercial partners. The interconnection among local small businesses is more dispersed as the owners tend to run their businesses without cooperating with each other.

Emergency Situation

Similar to the biological irritability system, a series of biological change within the body to react quickly to the external stimuli, all the agencies, organizations, and businesses reached out to and collaborated with each other when the strong hurricane and heavy rainfalls happening in Houston urban area, creating a new organization network structure, which is more condensed and interweaved.

Appendix 1 shows the agencies, organizations, and businesses engaged in emergency response to Hurricane Harvey as well as their activities. FEMA and other 17 federal agencies, (including the Coast Guard, Urban Search and Rescue Team, Department of Health and Human Services, U.S. Geological Survey, National Weather Service, Department of Housing and Urban Development, U.S. Army Corps of Engineers,

Environmental Protection Agency, Department of Energy, Department of Defense, U.S. Small Business Administration, Civil Air Patrol, Department of Agriculture, General Services Administration, Centers for Medicare and Medicaid Services, Department of Transportation, American Red Cross) came into the area after Hurricane Harvey and took powerful actions to conduct emergency relief works by collaborating with state and local agencies to integrate social resources for emergency response. All the activities of the public agencies activated emergency mode, aiming to rescue people and save property by all means.

For social organization sector, every non-profits organization, ethnic community, faith-based organization, philanthropy group, and volunteer organization searched for available resources within and outside of the organization itself in the area to provide comprehensive services for the affected people. Through the process of searching and integration, the collaboration among the social organizations is created or enhanced.

The most loosely connected private businesses sector also joined the collective efforts for emergency relief works. A lot of capable private business owners offered to provide free aid and resources for the victims, which included but not limited to food, clothes, clean water, shelters, and medical supplies. The collaboration forms such sector adopted were basically information sharing and direct provision or donation of material and money.

What should be emphasized is that the pillar enterprises of Houston like utility companies and basic engineering companies, have already built collaboration network within the sector and also with the public agencies, which was activated by the emergency of Hurricane Harvey.

From “Organizational Structure in Houston Under Emergency Circumstance” (Figure 3), the organizations are well connected with each other through various types of collaboration. The formal collaboration took the form of official cooperation, subsidy distribution and joint programs while the informal collaboration included information, services, and resources sharing as well as money and resources donation.

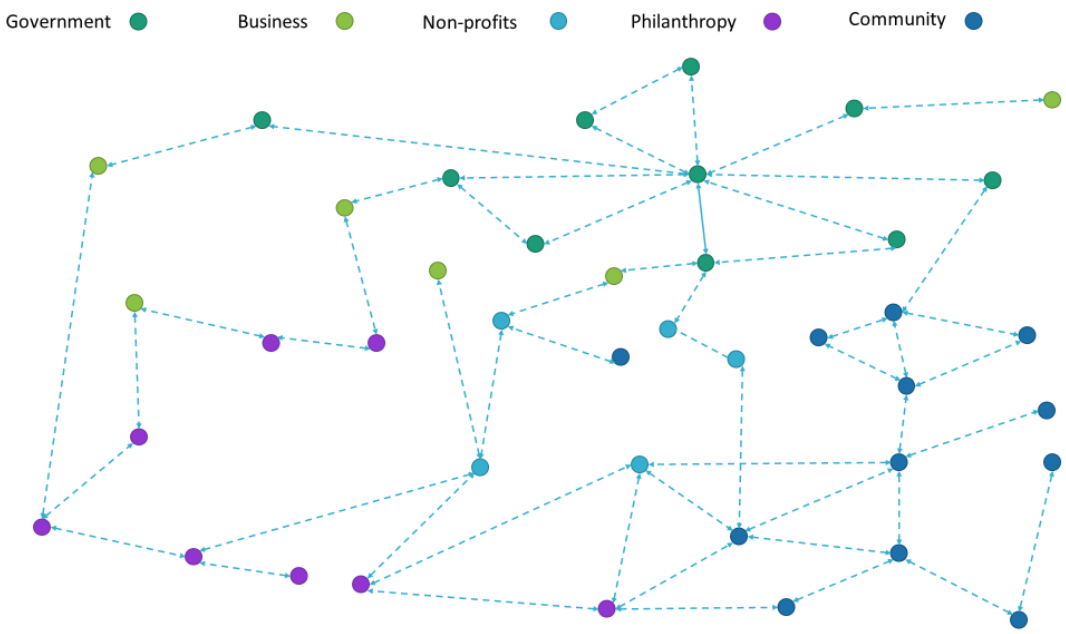

Figure 3 Organizational Structure in Houston Under Emergency Circumstance

Resources: Author created based on public reports

Emergency Response System Effectiveness

Under emergency circumstances, new connections among public sector, social organizations, and private businesses are built while the existing connections are strengthened and reinforced. The Organizational Structure in Houston is made up of more than 1,000 participants, providing comprehensive emergency response and relief works including rescue services, food assistance, shelter provision, transportation, medical services, disability services, mental health services, legal services, family and children assistance, refugee assistance, cash assistance, emergency financial assistance, utility assistance, job assistance, insurance assistance, home inspection, and environment management (City of Houston, 2017).

Though the emergency response system in Houston was comprehensive in meeting the needs of the people in the affected area, the whole process took more than a week (Hurricane Harvey, Wikipedia), which is still not efficient enough given the urgency of the response needs. This could be accounted as the difficulty for such a large-scale Organizational Structure to function as quickly as the smaller ones. Meanwhile, the process to establish new collaboration among the organizations also took much time, which could decrease the emergency response efficiency.

Impacts of the Organizational Structure on Emergency Response System Effectiveness

One motto Americans deeply believe in is that "necessity is the mother of invention", which is also true in the establishment of the Organizational Structure of emergency response system in Houston. People in different organizations reached out to each other when they need the collaborations among the organizations to achieve the shared goal of emergency relief, even though they haven't connected before the emergency. In other words, the interorganizational connections emerge and disappear based on the real-time needs of the relief works. Such Organizational Structure could be resilient to adjust to various conditions at a cost of efficiency.

Collaboration Forms

During emergency response phase, the collaboration forms within the structure can be divided into two categories, formal collaboration and informal collaboration. For formal collaboration, official cooperation, subsidy distribution and joint programs exist in the system, which is small in number but powerful in effect. Information, services, and resources sharing are most widespread in emergency response systems in Houston, supplementing the emergency response services significantly through community-level cooperation.

The informal collaboration took up the majority in Houston as most of the members in the Organizational Structure were social organizations and small private businesses. Information and services sharing among hundreds of organizations could cover a vast area of needs of the community members. However, it also has side effects in the potential of the redundancy, inaccuracy, and distortion of the information when passing through various organizations, which could hinder the efficiency of the structure.

. On the contrast with the case in Zhuhai, public agencies played as participants of the system instead of leaders or brokers. Though the number is limited, the agencies were still pretty powerful in the structure with formal collaborations. However, the heavy and tedious paperwork of the formal collaboration may impede the structural efficiency.

Structure Size

As listed in Appendix 1, the Organizational Structure in Houston involves more than 1,000 participants, which is over the capability of a lead organization to cope with. The Organizational Structure was established by the operation of every single participants at the same time, whose actions were highly autonomous and spontaneous without the supervision of a lead organization, or a broker organization.

Such structure is referred as shared self-governance by Provan and Kenis (2008), where the organizations could retain full control over the direction of the network. However, they also pointed out that as the number of organizations in the network gets larger, shared-governance becomes highly inefficient, with participants either ignoring critical network issues or spending large amounts of time trying to coordinate across 10, 20, or more organizations.

Meanwhile, the information and resources sharing, which is the main collaboration form of the Organizational Structure in Houston, could be hindered by the huge number of the participants. Organizations had to interact directly to each other, which is negative for network coordination when information flooding in. The information may get redundant, inaccurate, or even distorted when it passed through a large amount of people, which could further undermine the efficiency of the structure.

Nevertheless, the large number of participants engaged in the Organizational Structure could provide more comprehensive services to people as they could get exposed

to more aspects of the community. Organizations with full participation within the structure could get more information and make more contributions through intended or unintended ways.

Trust

In Houston case, the trust in the structure is established on future expectation. Such trust is gained through agreements, made in the early stages of a collaboration, in which trust serves as a substitute for formal contracts (Bradach & Eccles, 1989). The collaborations among the organizations in Houston are built when the organizations lacked background information about each other. Under the emergency circumstances, it is also unrealistic to obtain trust through risk management or historic activities.

The future-based trust has a lower standard and could be easily obtained as long as the organizations share the same expectation for the future. In our case, all the organizations in Houston consented on the objective, which is to minimize the negative impact of Hurricane Harvey in Houston urban area. Thus, the Organizational Structure was able to attract and retain a large amount of organizations, which is the premise of the comprehensiveness of the structure.

What should be noticed here is that once the shared goal is accomplished, the future-based trust could be able to turn to process-based or identity-based trust, which are gained through repeated interorganizational activities and thus, are more stable and

consistent. This could hoist the structural efficiency of the emergency response system in the future.

Legitimacy

Due to the high adaptation of the Organizational Structure, for which the collaboration among the organizations emerged or disappeared, the structure enjoys a higher level of external legitimacy with a relatively low internal legitimacy. In other words, the organizations are willing to join the emergency response structure during the emergency and they tend to leave the system after the emergency.

The shared systematic goal, which was to protect the Houston urban area from being devastated by the strong wind and heavy rainfall of Hurricane Harvey, was agreed by all the society. The external legitimacy could bring more organizations to the structure while the weak internal legitimacy may obstruct the efficiency of the emergency response system as the members are not clear about their role in the structure.

Zhuhai, China

Organizational Structure

Many may assume that the Organizational Structure in Zhuhai is totally different from that in the case of Houston, which should be highly centralized and hierarchical. Instead, the Organizational Structure in Zhuhai is kind of a mixture, hierarchical at

municipal and district level and horizontal at community level. The forms of the Organizational Structure are also different in regular situation and emergency situation.

Regular Situation

Figure 4 shows the Organizational Structure in Zhuhai under normal circumstance. In non-emergency situation, there exists apparent dividing line between community public sector and community organizations. It is a hierarchical-oriented structure with part of horizontal structure at community level.

Above the line, the hierarchical Organizational Structure, which is stable and enduring among the municipal, district, and community public agencies, holds the dominant power over the whole system. Routine workflow functions as the subordinate agencies undertake the missions from the superior agencies and reflect the execution information back to the superior. Each level of the public agencies enjoys certain discretion, but the overall execution must obey the guide from the higher-level agencies.

Below the line, the Organizational Structure becomes fuzzier as the community organizations join the network. The main collaboration forms among them is informal ones, including information and resources sharing, and co-hosted activities. The horizontal structure provides services directly to the community members but shares limited power over the whole system.

Through interviews, the community public sector seldom cooperates with the community organizations under normal circumstances. The public sector is in charge of governmental affairs solely at community level while the community organizations offer nonpolitical and professional services to meet the needs of the residents. The social services the community organizations provide is not as comprehensive as that in Houston, only including disability services, family assistance, legal consultation and children care.

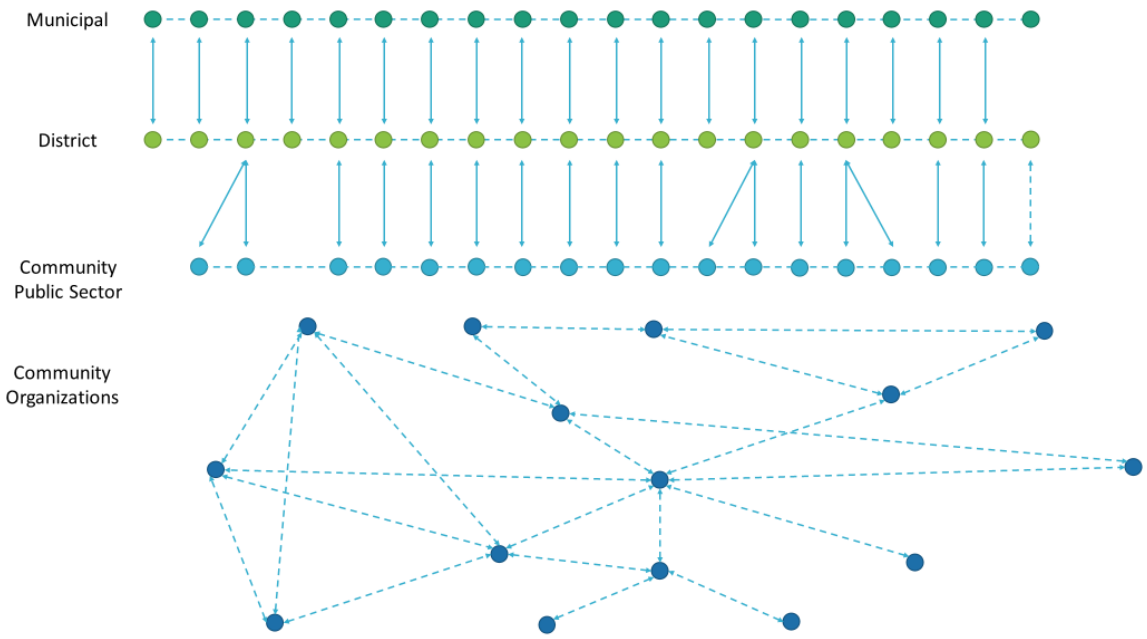

Figure 4 Organizational Structure in Zhuhai Under Regular Circumstance

Resources: Author created based on public reports

Emergency Situation

In wake of Super Typhoon Hato, the hierarchical structure above the line changed quickly as the District Flood, Windstorm, and Drought Control Office (Control Office) took

over the central position of the network and shouldered the responsibility of command center and information hub. All the public agencies at district level activated the emergency mode and followed the unified order of the Control Office once the emergency notice was released by the Control Office. The superior agencies at municipal level supervised the execution of the subordinate agencies at district level. Public agencies at district level would report the situation to the Control Office and their superior agencies at the same time. Community public sectors handled missions from district level intensively to maintain the regular operation of the affected communities.

Below the dividing line, more community organizations joined the network systems to better provide urgent services for affected people, and a lead organization emerged, which is NPI in Zhuhai's case. NPI, a public welfare organization generated by local community members, connected the public sectors and other community organizations as an information sharing bridge. It actively reached out to other social organizations and integrated the social resources to aid the areas where government has ignored or the rescue action has delayed.

Foreign social organizations also supported the community organization network by deploying professionals for assistance or donating money and materials. Shenzhen Sunshine Integrated Family Service Center and Guangdong Green Farming Social Work Development Center, based outside of Zhuhai, has also participated in the emergency response for Super Typhoon Hato.

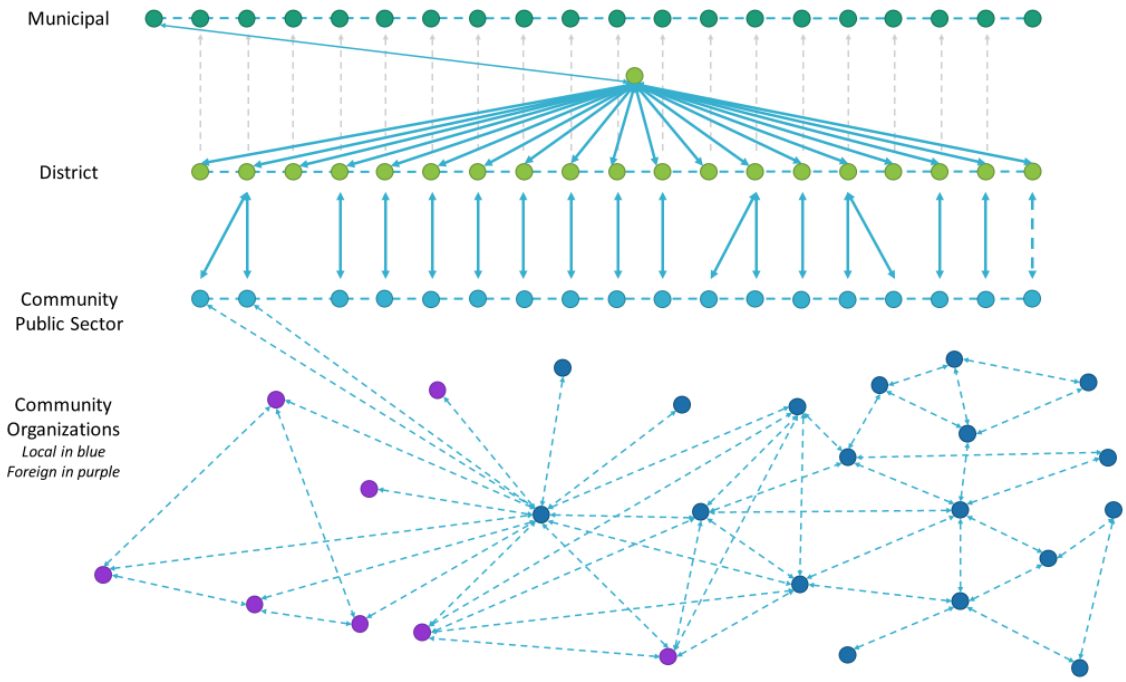

Figure 5 Organizational Structure in Zhuhai Under Emergency Circumstance

Resources: Author created based on public reports

Emergency Response System Effectiveness

Undoubtedly, the emergency response system in Zhuhai was way more efficient than that in Houston, which only took 4 days to accomplish 100% of the response works after the landfall of Super Typhoon Hato (Zhuhai Flood, Windstorm, Drought Control Office, 2017). The speediness requires the proficiency of the organizations in undertaking their own responsibilities within the structure, which is hard for Houston structure as many of the collaboration were new in wake of Hurricane Harvey.

Despite the efficiency of the Organizational Structure, the comprehensiveness of the Zhuhai structure needs to be improved. The long-existing hierarchical structure, which

is built on previous experiences, functioned by intuition, which is highly likely to ignore specific groups of people and the changing needs of the victims. In Zhuhai case, disabled people were not considered as carefully as that in Houston case. The mental health of the victims was also neglected when rescue mission was put as top priority.

Impacts of the Organizational Structure on Emergency Response System Effectiveness

Stability is highly appreciated in Chinese culture, which could be reflected by the Organizational Structure in Zhuhai case. The hierarchical structure inclines to build the trust among the organizations through its institution, reputation and historic interactions, all of which are time consuming and efforts required. The Organizational Structure established on a solid trust foundation are stable and enduring since its formation. The commands, information and resources could be passed through quickly and efficiently as all the members are familiar with the repeated activities. However, due to the characteristics of such structure, it is hard to monitor and maintain a large amount of organizations, which could lead to incomprehensiveness of the emergency response services.

Collaboration Forms

The most commonly observed collaboration forms among the organizations in Zhuhai is the official cooperation. The public agencies collaborated with one another in

specific realms by default quickly when the emergency took place. The schemes were rehearsed repeatedly in regular situation to prevent action delay in emergency situation because of unfamiliarity of the process. Such collaboration could be detected by the official documents recording the joint activities of different agencies.

Information and resources sharing is another collaboration form within the centralized structure. Control Office would play a central role in collecting and distributing information correctly and accurately to individual organization. Only the information relevant to the tasks of the organization would be passed to it, which enhanced the efficiency of the system dramatically.

In short, the familiarity of the emergency response system by all the member organizations in the structure, together with accurate information and resources sharing, help generate a high efficient emergency response system.

Structure Size

Compared to the Organizational Structure size of the emergency response system in Houston, the number of participants in Zhuhai is far smaller, with public agencies and social organizations totaled around 50. All the participants were coordinated and organized by a lead organization, which is the Control Office in Zhuhai case, serving as the command center and information hub in the structure.

Direct involvement of all organizations is no longer required for many network decisions (Provan & Kenis, 2008). The member organizations only need to interact with the

lead organization. In this centralized Organizational Structure, the structural operation and function could be highly efficient as the commands, information and resources flow fluently through the connections with accuracy and precision. The accelerated collaboration process could save much time and resources which are important in emergency situation.

However, efficiency comes in the Organizational Structure at the cost of inclusion and comprehensiveness. Shared network-level goals are achieved with some detailed needs being neglected. Nearly all the emergency response works were undertaken by public sector, with limited supplements from the social organizations at community level. Meanwhile, private businesses, which by potential, could booster the effectiveness of the system, had little participation and influence in the system.

For example, disability services, mental health services, emergency financial assistance, job assistance, insurance assistance, home inspection, and environment management were missed in Zhuhai.

Trust

The trust among organizations in the Zhuhai structure is acquired by organization reputation and historic activities, including “characteristic-based” trust, “norm-based” trust, “calculus-based” trust, and “institutional-based” trust. All of the types of trust are based on norms of obligation and cooperation– the expectation that an organization can or cannot be trusted because of the organization reputation (Creed & Miles, 2012). Such trust is

founded on a highly credible basis as the organizations put great efforts in building its reputation and the collaboration on it would be stable and consistent.

The organization reputation based trust could only be maintained within a small structure with certain amount of organizations. It is difficult that all the members have to agree on the participation of a new-comer by trust. Also, the more the organization members, the harder to inspect their historic activities. Such trust tends to be observed in public sector more frequently than in private sector. Thus, how the trust is obtained could be an explanation of the efficiency and incomprehensiveness of the structure in Zhuhai.

Legitimacy

Different from the case in Houston, the Organizational Structure in Zhuhai possesses higher internal legitimacy and external legitimacy. The Organizational Structure has existed for certain time period with all the participants knowing their roles well in the system and appreciating the shared network goal. The internal legitimacy contributes greatly to the efficiency in emergency response to Super Typhoon Hato.

At the same time, the external legitimacy is also strong in Zhuhai case. The whole society regards the emergency response system as a mighty and effective system, which could bring benefits to the community. Therefore, the resources are easily gained and utilized with efficiency.

Chapter 5 Implication and Conclusion

All the findings indicate that it is the stability of the collaboration relationships among the members that contribute to the differences of the four features, further the effectiveness of the Organizational Structure.

In Houston case, the structure is more resilient with the interorganizational relationships emerging or disappearing based on the real-time needs. Such a resilient structure could be built on a lower-standard trust type (future-based trust), gain a larger amount of participants. Given the instability of the structure, the participants usually cooperate with each other by informal forms like information and services sharing. It also enjoys a lower internal legitimacy as the connections are temporary and the members are not clear about their role in the structure.

In Zhuhai case, the structure is more stable with long-existing and consistent relationships among the members. The structure could only retain a small amount of organizations as the stable relationship need to be maintained with time and resources. The collaboration forms are official cooperation oriented, which implies the constant interaction among the organizations. The trust is established on the organization reputation, which is more difficult to acquire, and thus, more stable. It possesses high internal and external legitimacy as the repeated activities within the structure have prepared the members well with the emergency situation.

Based on the analysis of the two cases, any Organizational Structure that share the similar characteristics of the emergency response system in Houston should figure out a way to maintain its stability so that the system could be more efficient. And the structures analogical to the one in Zhuhai should seek more resilience in their structure to adjust to various scenarios.

All in all, this paper aims to answer the question- what is the impact of Organizational Structure on the effectiveness of the emergency response system by the comparison of the two cases, one in Houston and one in Zhuhai. With governmental and organizational report analysis and semi-structure interviews, the result turns out that the Organizational Structure of Houston is more horizontal and distributed while that in Zhuhai case is more hierarchical and denser. Accordingly, the effectiveness of the emergency response systems of the two cases are different, where the Houston case is more comprehensive and the Zhuhai case is more efficient. The differences could be explained by four features rooted in the Organizational Structures, which are collaboration forms, structure size, trust, and legitimacy.

First of all, the majority of the collaboration forms in Houston case are information and services sharing. The information and services flow among hundreds of organizations could cover a vast area of the needs of the community members while the potential of the redundancy, inaccuracy, and distortion of the information when passing through various organizations could hinder the efficiency of the structure. On the other hand, the most

commonly observed collaboration forms among the organizations in Zhuhai is the official cooperation. Control Office has played a central role in collecting and distributing information correctly and accurately to individual organization, which leads to the organization efficiency.

Secondly, the Organizational Structure in Houston involves more than 1,000 participants, which is over the capability of a lead organization to cope with. The large number of participants engaged in the Organizational Structure could provide more comprehensive services to people as they could get exposed to more aspects of the community. Meanwhile, it is hard to coordinate such large amount of organizations, contributing to the inefficiency of the Organizational Structure in Houston. Compared to the Organizational Structure size in Houston, the number of participants in Zhuhai is far smaller, making it easier to operate and function. However, shared network-level goals are achieved with some detailed needs being neglected.

Thirdly, the future-based trust in Houston case has a lower standard and could be easily obtained as long as the organizations share the same expectation for the future. More organizations would be attracted to and participate in the structure. On the contrast, the trust among organizations in the Zhuhai structure is acquired by organization reputation and historic activities, which is harder to acquire and maintain. Thus, it is more stable and consistent once established.

Lastly, due to the high adaptation of the Organizational Structure in Houston, for which the collaboration among the organizations emerged or disappeared, the structure enjoys a higher level of external legitimacy with a relatively low internal legitimacy. Different from the case in Houston, the Organizational Structure in Zhuhai possesses higher internal legitimacy and external legitimacy. Higher internal legitimacy could result in a more efficient system while higher external legitimacy could gain resources outside of the structure more easily.

Combined the advantages and disadvantages of the two cases, one system should strike a balance between efficiency and comprehensiveness by integrating stability and resilience in the Organizational Structure.

Appendix

Interview Questions

1. What did your agency/organization do during the emergency response period? What kind of aid have you provided in the affected area?
2. Did your agency/organization collaborate with other governmental agencies and community organizations when responding to the emergency?
3. To what extent do you agree with the statement that the collaboration among different governmental agencies and non-governmental organizations has a strong positive influence on the effectiveness of the emergency response system at community level? Could you rate the extent with a scale from 1 to 5, for which 1 is totally disagree, 2 is partly disagree, 3 is neutral, 4 is partly agree and 5 is totally agree?
4. To what extent do you agree that the effectiveness of the emergency response system has improved through such collaboration? Could you rate the extent with a scale from 1 to 5, for which 1 is totally disagree, 2 is partly disagree, 3 is neutral, 4 is partly agree and 5 is totally agree?

Appendix 1 Agencies and Organizations Engaged in Emergency Response to Hurricane Harvey (Activities Included for Partial)

Public Agencies	
Federal Level	
Federal Emergency Management Agency (FEMA)	• Supplied 3 million meals, 3 million liters of water, 9,900 blankets, 8,840 cots and 10,300 hygiene kits to the state for distribution to survivors; • Quickly provided $186 million in Public Assistance funding to reimburse local and state agencies for the cost of emergency protective measures and debris removal; • Deployed teams of specialists to neighborhoods and disaster recovery centers to help Texans with registration and questions about disaster assistance; • Coordinated National Business Emergency Operations Center calls among 150 private sector partners working on disaster response • Worked with social media companies to share disaster information and assisted cell service companies in providing charging stations for disaster survivors.
Coast Guard	• Deployed 2,060 personnel, 50 aircraft, 75 boats and 29 cutters; • Rescued 11,022 people and 1,384 pets.
Urban Search and Rescue Team (USAR)	Rescued 6,453 people and 237 animals using boats and high-water trucks
Department of Health and Human Services (HHS)	• Deployed more than 1,110 personnel with medical equipment and supplies; • Provided medical care to 5,359 patients and conducted 60 shelter assessments
U.S. Geological Survey (USGS)	• Forecast storm surge and beach erosion; • Worked through Harvey's landfall to keep the NWS informed of real-time flooding
National Weather Service (NWS)	Posted real-time flooding information to the public

Department of Housing and Urban Development (HUD)	• Contacted all 61 public housing authorities in the disaster area to assess damage and to identify unoccupied units that could be made available to HUD-assisted and other survivors (91 public housing developments that serve 200,000 families); • Assessed FHA-insured apartment complexes, comprising 50,000 units, of which 20,000 have direct HUD rental assistance; • Canvassed the four-state area surrounding the disaster for available public housing and multifamily housing units.
U.S. Army Corps of Engineers (USACE)	• Deployed 390 personnel to clear navigation channels, allowing critical ports to resume operations; • Performed generator inspections and installations to provide temporary emergency power at critical locations and provided technical assistance for debris, temporary housing and commodities missions.
Environmental Protection Agency (EPA)	• Completed 625 drinking water assessments and 441 waste water assessments; • Conducted assessments of 43 Superfund sites and recovered 517 containers of unidentified, potentially hazardous material.
Department of Energy (DOE)	• Supported in efforts to restore power to more than 300,000 customers; • Contacted Texas Division of Emergency Management and utility companies for assistance; • Worked with the EPA to issue waivers that allowed more fuel to go into the supply pipeline; • Authorized release of 5.3 million barrels of crude oil from the Strategic Petroleum Reserve as a resource if needed.
Department of Defense (DOD)	• supported more than 30 mission assignments from FEMA that included search and rescue, strategic airlift, transportation, evacuation, installations support, patient movement and logistics; • Rescued nearly 3,000 people
U.S. Small Business Administration (SBA)	• Opened five business recovery centers to provide a wide range of services to businesses impacted by the disaster;

	• Extended the deferment for first payment from the standard five months to 11 months from the date the borrower signs the loan closing documents; • Provided an automatic 12-month deferment of principal and interest payments for SBA-serviced business and disaster loans.
Civil Air Patrol	Conducted 270 flights with 32 aircraft to assist with emergency response
Department of Agriculture (USDA)	• Activated the Disaster Supplemental Nutrition Assistance Program to provide food benefits to households; • Allowed schools in hurricane-stricken areas to provide free meals to all students through the National School Lunch Program; • Deployed 25 tons of pet food to affected areas and used helicopters to identify stranded livestock; • Assisted the Texas National Guard in dropping 210,000 pounds of hay to 10,000 head of livestock.
General Services Administration (GSA)	Leased facilities to provide work sites for several thousand federal employees deployed to Texas, including a joint state/federal field office, area field offices and call centers.
Centers for Medicare and Medicaid Services	Temporarily modified the Medicare, Medicaid and Children's Health Insurance Program to provide immediate relief to Texas disaster survivors
Department of Transportation (DOT)	• Provided technical assistance, training and on-site damage assessments to begin returning transportation infrastructure to pre-storm conditions; • Deployed 36 employees in the response effort to assist in emergency repairs under the Emergency Relief Program with an initial $25 million in quick-release funds; • Monitored the operation of all major airports in the affected area; • Conducted damage inspection on emergency repairs completed and permanent repairs to be completed.
American Red Cross	• Provided $45 million to more than 100,000 disaster survivors to help them with immediate needs; • Deployed more than 3,000 staff and volunteers, 171 emergency response vehicles, served 965,000 meals

	and 1 million snacks and operated shelters throughout the impacted counties
State and Local Level	
Texas Department of Emergency Management	
Texas Department of Transportation	
Texas Department of Public Safety	
Texas Gulf Coast Small Business Development Center	
Texas Commission on Environmental Quality	
Texas Division of Emergency Management	
Texas Workforce Commission	Processed 136,576 unemployment insurance claims, of which 17,714 were under the Disaster Unemployment Assistance (DUA) program.
Texas National Guard	
Houston Administration and Regulatory Affairs Department	
Houston Aviation Department	
Houston Commission on Disabilities	
Houston Information Technology Department	
Houston Police Department	
Houston Department of Health and Human Services	
Houston Emergency Management Department	
Houston Finance Department	
Houston Parks and Recreation Department	
Houston Planning and Development Department	
Metropolitan Multi-Service Center	
Ethnic Community Organizations	
Alliance for Multicultural Community Services	Translation services, assistance with legal services, case management, and other specialized resources to assist immigrant and refugee communities.
Arab American Cultural & Community Center (ACC) Houston	Collected donations for local area shelters.
Bangladesh Association, Houston	Collected and distributed supplies.
Boat People SOS (expertise with the Vietnamese community)	Translation services, assistance with legal services, case management, and other specialized resources to assist immigrant communities.

Central American Resource Center (CRECEN)	Provided pro bono work to help replace lost immigration documents.
Chinese Community Center	Offered FEMA relief works assistance.
Ethiopian Community Organization in Houston (E.C.O.H)	Offered FEMA relief works assistance.
Filipino Young Professionals of Houston	Created a relief fund to be used to purchase food for first responders and people in Houston shelters
Houston Hispanic Forum	Offered emergency relief works assistance.
Houston Indian Community Association	Offered emergency relief works assistance.
Hungarian American Cultural Association of Houston (HACA)	Offered emergency relief works assistance.
India House	Offered emergency relief works assistance.
Iranian Cultural Foundation-Houston	Offered emergency relief works assistance.
Italian Cultural & Community Center	Offered emergency relief works assistance.
Japan America Society of Houston	Hosted a school supply drive.
Korean Community Center of Houston	Offered emergency relief works assistance.
The Nigerian Foundation	Hurricane relief fund established.
Nigerian Muslim Association of Greater Houston	Offered emergency relief works assistance.
Order of American Hellenic Educational Progressive Association (AHEPA) Chapter 29	Offered emergency relief works assistance.
Pakistan Association of Greater Houston	Offered emergency relief works assistance.
Polish American Council of Texas	Offered emergency relief works assistance.
Taiwanese Heritage Society of Houston	Offered emergency relief works assistance.

Texas German Society: Harris County Chapter	Offered emergency relief works assistance.
United Russian American Association	Offered emergency relief works assistance.
Vietnamese American Community Center	Offered basic food supplies and helped with FEMA relief works.
Vietnamese Culture and Science Association	Offered emergency relief works assistance.
Faith-based Groups	
Aishel House	Provided housing and kosher food to hurricane victims
Bellaire Jewish Center	Pick-up location for supplies and gift cards
Catholic Charities	• Hosted workshops to assist immigrant/refugee victims; • Established a disaster relief fund; • Collected in-kind donations; • Offered helpful info regarding shelters, legal assistance, food pantries, etc.
Chabad Lubavitch Center	Offered food, kosher meals, supplies, counseling and disaster- related assistance
The Church of Jesus Christ of Latter Day Saints	Collected monetary and in-kind donations prepping to support victims of Harvey
Evelyn Rubenstein Jewish Community Center of Houston	Pick-up location for all sorts of supplies, gift cards, etc.
Interfaith Ministries	Collected monetary donations on behalf of senior citizens and Houston refugees
Islamic Society of Greater Houston	Offered food, shelter, counseling and supplies at affiliated mosques
Jewish Federation of Greater Houston	• Coordinated relief efforts; • Provided donations and gift cards.
Meyerland Minyan	• Pick-up location for supplies (including towels, bedding, etc.) and kosher meals; • Coordinated housing in the community for flooded families.
Robert M. Beren Academy	• Raised donations for school community • Pick-up location for Kosher meals
SEWA International	• Over 500 volunteers worked around the clock to rescue stranded families;

	• Food, supplies and essentials were sent to the shelters; • Volunteers were out on the road with trucks and boats to help people; • Doctors offered free medical consultation.
Southern Baptists of Texas	• Offered disaster relief ministry; • Collected monetary and in-kind donations • Prepared churches around the region to open as shelters
Tzu Chi	• Sent relief volunteers to Houstonians in need of aid; • Hurricane relief fund established.
Volunteer Groups (300+)	
Volunteer Houston, Salvation Army, AmeriCorps Disaster Response Team, Cajun Navy, etc.	Worked to remove muck from homes, support shelters, feed people, distribute supplies, provide emotional and spiritual care, clean up debris, repair and rebuild housing and provide crisis support.
Philanthropy Groups (50+)	
United States Equestrian Federation, Humane Society of the United States, Knights of Columbus, Catholic Charities USA, AmeriCares, Operation BBQ relief, etc.	Donated money and materials to the affected areas.
Private Businesses	
Utility Companies (20+)	• Activated the mutual support networks; • Assigned more than 10,000 workers from at least 21 states to the response and recovery effort, including crews, line workers and support personnel.
Local Small Businesses (500+)	Provided food, water, medical supplies free to the victims in the area; Assisted with the emergency relief works.

Appendix 2 Agencies and Organizations Engaged in Emergency Response to Super Typhoon Hato

Municipal Level
Municipal Flood, Windstorm, Drought Control Office
Municipal Government General Office
Municipal Committee
Municipal Committee Publicity Department
Municipal People's Armed Forces Department
Municipal Emergency Management Office
Municipal Development and Reform and Statistics Bureau
Municipal Science & Technology and Information Bureau
Municipal Education Bureau
Municipal Finance Bureau
Municipal Civil Affairs Bureau
Municipal Housing and Urban-Rural Development Bureau
Municipal Forestry Bureau
Municipal Urban Management Administration and Enforcement Bureau
Municipal Culture, Sports and Tourism Bureau
Municipal Marine, Agriculture and Water Resources Bureau
Municipal Administration Bureau
Municipal Health and Family Planning Bureau
Municipal Aviation Industry Bureau
Municipal Public Security Bureau
Municipal Land and Resources Bureau
Municipal Power Supply Bureau
District Level
District Flood, Windstorm, Drought Control Office
District Government General Office
District Committee
District Committee Publicity Department
District People's Armed Forces Department
District Emergency Management Office
District Development and Reform and Statistics Bureau
District Science & Technology and Information Bureau
District Education Bureau
District Finance Bureau
District Civil Affairs Bureau

District Housing and Urban-Rural Development Bureau
District Forestry Bureau
District Urban Management Administration and Enforcement Bureau
District Culture, Sports and Tourism Bureau
District Marine, Agriculture and Water Resources Bureau
District Health and Family Planning Bureau
District Administration Bureau
Jinwan Public Security Branch Bureau
Jinwan Branch of Municipal Land and Resources Bureau
Jinwan Power Supply Bureau
Jinwan Water Supply Company
Community Public Sector
Sanzao Town Government
Hongqi Town Government
Town Committee Publicity Department
Economic Development Office
Telecom Office
Education Office
Finance Office
Civil Affairs Office
Forestry Station
Town and Village Planning Office
Agriculture, Forestry and Water Office
Jinwan Fishery Group
Health Institutes
Town Police Station
Sanzao Town Border Detachment
Land and Resources Office
Power Supply Office
Water Management Office
Community Organizations
Zhuhai NPI Non-Profit Development Center
Zhuhai Integrated Youth Service Center
Zhuhai Deyang Social Work Service Center
Zhuhai Yongkang Social Work Service Center
Zhuhai Hengai Integrated Social Work Service Center
Zhuhai Xiangqing Social Work Service Center
Zhuhai Positive Energy Social Work Development Center
Zhuhai Yude Social Work Service Center

Zhuhai Sanzao Town Qinghui Youth Integrated Service Center
Shenzhen Sunshine Integrated Family Service Center
Zhuhai Ideal Big Family Charity Association
Zhuhai Jiale Social Work Service Center
Guangdong Green Farming Social Work Development Center
Zhuhai Jixing Social Work Service Center
Sanzao Town Qingqingyuan Migrant Youth Comprehensive Service Center

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